National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Aerial Survey of Dall's Sheep

Yukon-Charley Rivers National Preserve, July 2015

Natural Resource Report NPS/YUCH/NRR—2015/1020

ON THE COVER
Dall's sheep rams in Yukon-Charley Rivers National Preserve, July 2015.
Photograph by: Kyle Joly

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Abstract/Executive Summary

A minimum count survey of Dall's sheep (*Ovis dalli*) in Yukon-Charley Rivers National Preserve was conducted from July 14 to 16, 2015. The Preserve was last surveyed in July of 2009. The current survey examined the same 7 mountain units as the previous survey, but the Ogilvie Mountains were also surveyed. In the core area (the 7 units most often surveyed), 173 sheep (86 ewes, 39 lambs, 12 yearlings and 36 rams) were detected. This constitutes a 48 % decline from the last (2009) survey. The previous lowest count was 282 sheep in 1998. Also within the core, there were 45 lambs, 14 yearlings, and 42 rams per 100 ewes. Of the 36 rams detected, 5 (14 %) were classified as legal (full curl or greater, tips of both horns broken ("broomed") and/or at least 8 years of age). Using a sightability correction factor of 1.1, 190 sheep were estimated to be in the core area of the Preserve. Survey flight time in the R44 helicopter was 11.93 hours for the core area. In the Ogilvie Mountain unit, 39 sheep were detected (9 ewes, 5 lambs, 1 yearling and 24 rams). This translates to 56 lambs, 11 yearlings and 267 rams per 100 ewes. Of the 24 rams found in this unit, 3 (13 %) were classified as legal. Only 2.25 hours of survey flight time was used in this unit. Given the size of the unit and amount of potential sheep habitat, I recommend allotting more time to survey this unit in the future. The survey, in its entirety, incurred $18,395 in aviation costs (not accounting for fuel which was available at National Park Service tanks in Coal Creek and Eagle).

Acknowledgments

Rick Swisher (Quicksilver Air) safely piloted the R44 helicopter and served as the second observer. Mat Sorum, Matt Cameron and John Burch provided technical assistance. Jeff Wells, with the Alaska Department of Fish and Game, compiled harvest data from 1995-2014. I thank Kumi Rattenbury for helpful comments on a previous draft on this report.

Introduction

Dall's sheep (*Ovis dalli*) inhabit the mountains and river bluffs of Yukon-Charley Rivers National Preserve (YUCH) at low density. Hunting, both sport and subsistence, of sheep is allowed in the Preserve. Since 1993, the sport hunt has been "open" (*i.e.*, it is not limited to a certain amount of drawing permit holders). Sheep surveys in the YUCH area started as early as 1973 (Burch 2010). Since 1997, aerial sheep surveys in YUCH have focused on 7 units (Figure 1; 5580 Mountain, Charley River Bluffs, Cirque Lake, Copper Mountain, Diamond Fork Mountain, Mount Sorenson and Twin Mountain). Major declines in sheep populations from across Alaska in 2013 and 2014, and the fact that the sheep population had not been surveyed since 2009 helped prompt this project.

Minimum count surveys have been used to monitor this population. Newer techniques, such as distance sampling (Schmidt *et al*. 2012), may not be appropriate for surveying YUCH sheep as the population size and density is relatively low, with relatively few groups of sheep.

Study Area

The survey area is roughly bounded by YUCH's boundary (Figure 1). Dall's sheep inhabit the mountains in the southwestern area of the Preserve, the bluffs along the Charley River, the hills and bluffs in the upper Seventymile River, and the hills and bluffs in upper Woodchopper Creek. Sheep also occur in the northeastern portion of the Preserve in the Ogilvie Mountains which straddle the Alaska-Canada border. The Ogilvie Mountains were included in this survey but have been excluded in previous studies (Burch 2010).

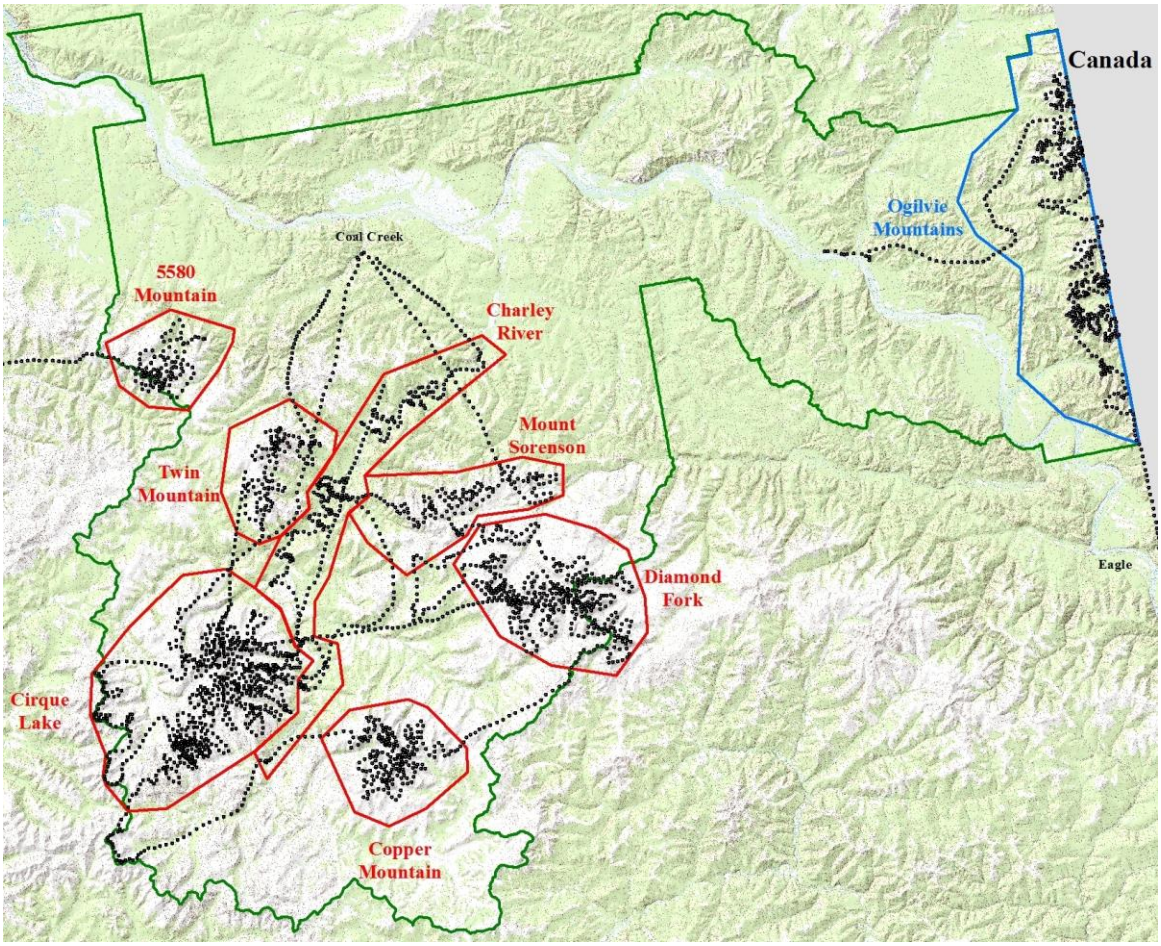

Figure 1. Yukon-Charley Rivers National Preserve and sheep survey unit boundaries. Green polygon is the boundary of the Preserve. Red polygons denote the core 7 survey units and the blue polygon represents the Ogilvie Mountain survey area. Dark grey dots represent the survey route.

Methods

A minimum count survey was performed using a Robinson R-44 II helicopter piloted by Rick Swisher (Quicksilver Air), who also acted as an observer. The other observer was Kyle Joly. The survey employed the techniques used in the previous 3 surveys (Burch 2010). Each unit was surveyed from one end to the other, flying each mountainside and then the ridge top above, then the next mountain side (as opposed to flying contours around the mountain until the starting point was reached again and then flying the next contour around) until complete coverage was reached. Although slower, mixing this technique with contour flying provides faster coverage of individual drainages thereby reducing the chance of double counting or missing sheep that move over the top of a ridge. The flying was performed in such a way as to be able to see all the terrain that sheep might occupy above shrub line except for the Charley River unit (which is completely below the shrub line). Typically this was readily accomplished with a single pass through a particular area, but 2 or 3 passes were made in areas of steep, vertical, broken terrain, or in areas with patches of snow or dark shadows. When groups of sheep were spotted, the helicopter flew in close to sex and age each individual by horn size and shape, and body size. Sex-age classes included lambs, yearlings, ewes, sub-legal rams and legal rams (full curl or greater, tips of both horns broken ("broomed") and/or at least 8 years of age). The flight path was recorded via Global Positioning System (GPS) track files (Figure 1) and a waypoint stored for the location of each group of sheep. Data were reported as a minimum count and with a sightability correction factor of 1.1 based on Lawler *et al*. (2005).

Results

Survey logistics and conditions

The survey was conducted from July 14 to 16, 2015. Survey flight time in the R44 helicopter was 11.93 hours for the core area (the 7 units most often surveyed). The units flown on July 14 were 5580 Mountain, Charley River, Mount Sorenson and Twin Mountain. Diamond Fork, Copper Mountain and a portion of the southern extent of Cirque Lakes were flown on July 15. The remainder of Cirque Lakes and the Ogilvie Mountains were flown on July 16. Only 2.25 hours of survey flight time was used in the Ogilvie Mountains unit. Overall, weather conditions for the survey were very good, with high overcast skies and calm winds for most of the survey. For very limited times and locations, rain and clouds hindered sightability but likely did not impact survey results. There was virtually no snow present even at the highest elevations and on the lee side of ridges. The temperature at survey altitudes ranged from 10° - 20° C (50° - 70° F). The survey, in its entirety, incurred $18,395 in aviation costs (not accounting for fuel which was available at National Park Service tanks in Coal Creek and Eagle).

Core Area Survey Results

A total of 173 sheep (86 ewes, 39 lambs, 12 yearlings and 36 rams) were detected. Using a sightability correction factor of 1.1 (see Lawler *et al*. 2005), 190 sheep were estimated to be in the core area of the Preserve. There were 45 lambs, 14 yearlings, and 42 rams per 100 ewes. Of the 36 rams detected, 5 (14 %) were classified as legal (full curl or greater, tips of both horns broken ("broomed") and/or at least 8 years of age). See Table 1 for a unit by unit accounting. There are now 7 years (i.e., 1997, 1998, 1999, 2001, 2002, 2009 and 2015) in which all 7 core units were surveyed, allowing for direct comparisons (Figure 2).

Table 1. Results of the July 2015 Yukon-Charley Rivers National Preserve sheep survey. Survey time is in hours.

Survey Unit	Survey Time	Total Sheep	Ewes	Lambs	Yearlings	Rams	Lambs/ 100 ewes	Yearlings/ 100 ewes	Rams/ 100 ewes	% Legal Rams
5580 Mtn	0.68	12	7	3	0	2	42	0	29	0
Charley River	1.92	66	36	22	6	2	61	17	6	0
Cirque Lake	4.33	35	12	5	4	14	42	33	117	21
Copper Mtn	1.33	11	4	0	1	6	0	25	150	17
Diamond Fork	2.00	2	1	0	0	1	0	0	100	0
Mt Sorenson	0.67	38	26	9	0	3	35	0	12	0
Twin Mtn	1.00	9	0	0	1	8	-	-	-	13
Total	11.93	176	86	39	12	36	45	14	42	14

Ogilvie Mountain Unit Survey Results

A total 39 sheep were detected (9 ewes, 5 lambs, 1 yearling and 24 rams). This translates to 56 lambs, 11 yearlings and 267 rams per 100 ewes. Of the 24 rams found in this unit, 3 (13 %) were classified as legal.

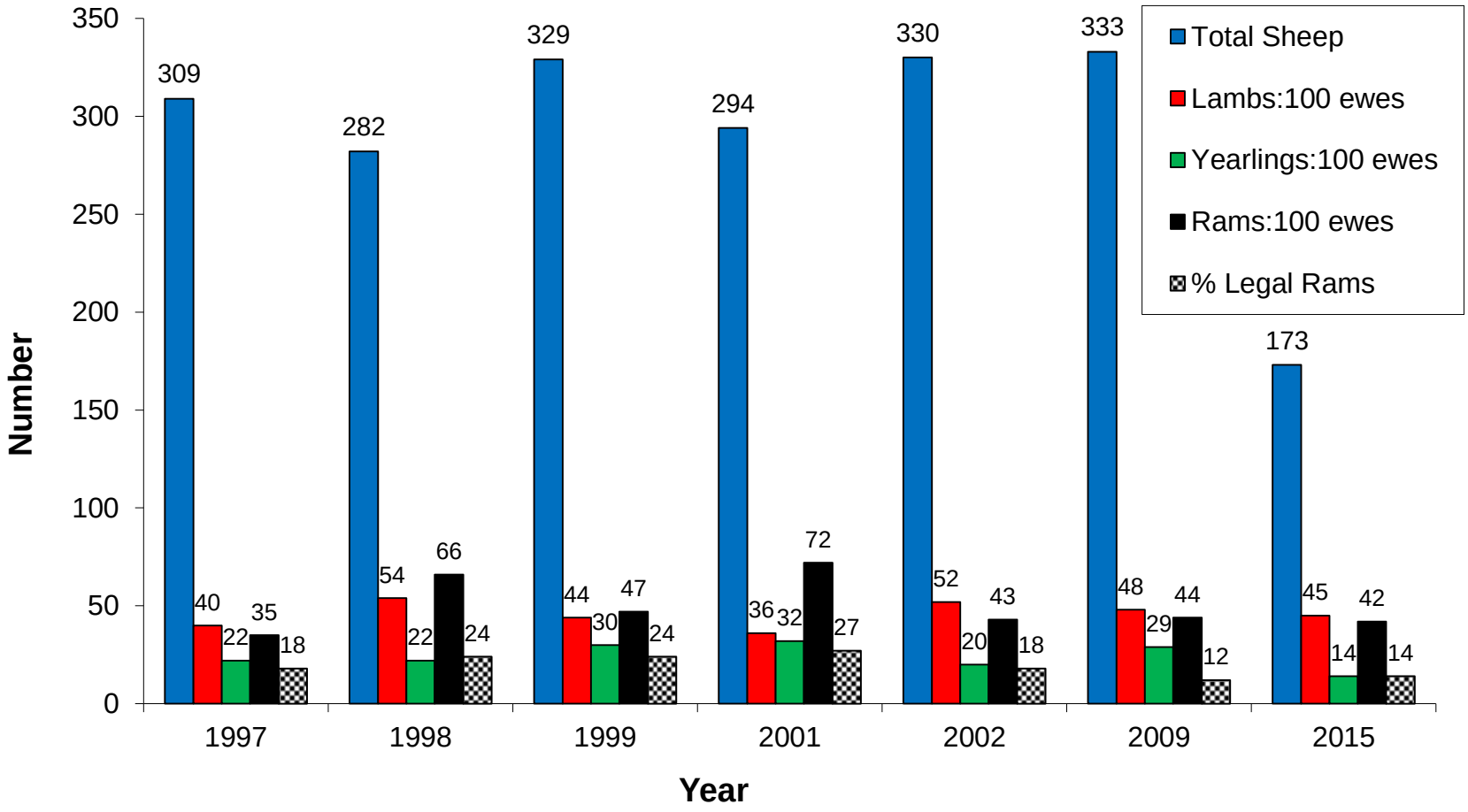

Figure 2. Dall's sheep demographic trends in the core 7-unit area of Yukon-Charley Rivers National Preserve, 1997-2015.

Miscellaneous Results

No collared sheep or dead sheep were found during the survey, unlike in 2009 (Burch 2010). Kathul Mountain and a few Yukon River bluffs (*e.g.*, Biederman Bluff) were flown while in route to the Ogilvie Mountain unit; no sheep were observed. A group of 4 sheep (1 ewe, 1 yearling and 2 sub-legal rams) were found within YUCH but outside, to the southwest of the Cirque Lake unit. These sheep were not counted as part of the core area. Sheep with black tails and gray to black hair on their bodies are known to occur within the Preserve (Burch 2010). Sheep with these colorations have been called Fannin sheep or Stone sheep (*Ovis dalli stonei*). Stone sheep are found in northern British Columbia and southern Yukon Territory, and are distinctively not white. So called Fannin sheep have been described as an intergrade between Dall's sheep and Stone sheep. During the survey, photo-documentation of the presence of Fannin-colored sheep within the Preserve was obtained (Figure 3).

Figure 3. Dall's sheep, Yukon-Charley Rivers National Preserve, July 2015. Sheep, such as this ewe, with black tails and dark hair on their body are sometimes referred to as Fannin sheep or Stone sheep. Photo: K. Joly.

Discussion

The 2015 survey revealed a 48 % decline in the Dall's sheep population within the core area of Yukon-Charley Rivers National Preserve since 2009. Declines were greatest in the yearling and legal rams categories. While evaluating trends in the sheep population can be difficult (Burch 2010), the number of sheep observed in this survey represents a 39 % decline from the previous lowest number of sheep ever reported (1998, which was thought to be low due to less time used to survey, Burch 2010). The largest decline in any 1 survey unit was in the Diamond Fork where only 2 sheep were observed, versus 50 in 2009. The low sheep numbers are reflective of regional decline (many areas of Alaska and the Yukon Territory; personal communications with K. Rattenbury and T. Hegel). While the cause of the declines is not known for certain, the difficult winter of 2011-2012, the very cold spring of 2013, and winter icing events from 2010-2014 are thought to be strongly influential. Harsh winter conditions disproportionately affect young and old individuals, and can impact recruitment. The decline in sheep from 2009 to 2015 took place during a period when the State of Alaska undertook aggressive and successful actions to substantially reduce the number of wolves (*Canis lupus*) around the Preserve. Thus wolf predation was likely not a primary factor.

The 14 yearlings: 100 ewes observed in 2015 was the lowest ratio ever reported for this area. The number of yearlings in 2015 (12) was 72 % lower than the number observed in 2009 (42). The number of legal rams declined by 58 % during this period as well. This also is the lowest number ever reported for the core area of the Preserve. The 2 lowest reported percentages of legal rams have been for the last 2 surveys. Recent (2006-2014) reported sheep harvest in the entire Preserve has been relatively modest at about 3.3 per year, as compared to 1995-2005 when it was about 7.5 sheep per year (Appendix B). During and just after a period when the only hunt was a drawing permit limited to 4 hunters (1983-1994), the average reported harvest was about 1.5 sheep per year. Reported sheep harvest was low (n=2) in 2009 when absolute number and percentage of legal rams were low – which may support the concept, at least in this study area, that full-curl hunts will result in low harvest when there is low abundance (*i.e.*, that it is self-regulating). However, the sample size of 1 (just 2009) and the fact that the past 2 surveys have had the lowest percentage of legal rams is cause for caution in giving too much credence to the concept. Harvest data for 2015 was not available for analysis for this report.

The past two winters have been relatively mild. The lamb: 100 ewe ratio for 2015 was right at the average for all years for the core area. However, given the large decline in the absolute number of ewes, recovery of the Dall's sheep population in Yukon-Charley Rivers National Preserve may take some time even with continued favorable weather – especially in the Diamond Fork unit.

I recommend continuing to fly all of the core units because it allows for direct comparisons from previous years and decreases the chances of spurious results stemming from movements among (un)surveyed areas (Lawler *et al.* 2005, Burch 2010). Preserve administrators should contemplate surveying the Preserve within the next few (2-4) years to see if the population is

rebounding from the decline, continuing to decline, or has stabilized. The R-44 helicopter remains the survey platform of choice for the Preserve and the current survey methodology continues to work well. More time should be devoted to the Ogilvie Mountains unit the next time it is surveyed because of the amount of terrain, its complexity and the number of visible sheep trails. The 2015 survey likely missed some sheep due to limited amount of survey time.

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Schmidt, J. H., K. L. Rattenbury, J. P. Lawler and M. C. Maccluskie. 2012. Using distance sampling and hierarchical models to improve estimates of Dall's sheep abundance. Journal of Wildlife Management 76: 317-327.

Appendix A – Data summary by survey unit for Yukon-Charley Rivers National Preserve, 1983 – 2015.

				Total Counts				Per 100 Ewes			Rams		
Survey Unit	Year	Total Sheep	Survey Time	Ewes	Lambs	Yearlings	Rams	Lambs	Yearlings	Rams	Legal	Sublegal	% Legal
Diamond Fork	1983	7	N/A	0	0	0	7	0	0	0	2	5	29
	1990	19	1.7	2	2	0	15	100	0	750	6	9	40
	1997	11	1.8	1	0	2	8	0	200	800	4	4	50
	1998	37	2.0	11	5	5	16	45	45	145	6	10	38
	1999	18	2.7	0	0	0	18				7	11	39
	2001	41	2.4	7	4	3	27	57	43	386	9	18	33
	2002	55	2.5	22	5	6	22	23	27	100	7	15	32
	2009	50	2.2	19	7	3	21	37	16	111	4	17	19
	2015	2	2.0	1	0	0	1	0	0	100	0	1	0
	Mean	27											
Cirque Lakes	1983	66	N/A	26	10	9	21	38	35	81	10	11	48
	1984	27	4.8	16	4	8	1	25	50	6	0	1	0
	1990	107	2.5	47	15	19	26	32	40	55	13	13	50
	1993	58	2.5	38	9	1	10	24	3	26	0	10	0
	1994	63	2.6	21	9	9	24	43	43	114	3	21	13
	1995	76	3.2	27	9	11	29	33	41	107	7	22	24
	1997	77	3.2	42	13	3	19	31	7	45	5	14	26
	1998	62	2.1	18	9	3	32	50	17	178	7	25	22
	1999	69	3.7	33	13	15	8	39	45	24	3	5	38
	2001	52	3.4	16	4	5	23	25	31	144	5	18	22
	2002	57	2.6	28	16	7	6	57	25	21	1	5	17
	2009	41	3.7	20	7	5	9	35	25	45	2	7	22
	2015	35	4.3	12	5	4	14	42	33	117	3	11	19
	Mean	61											

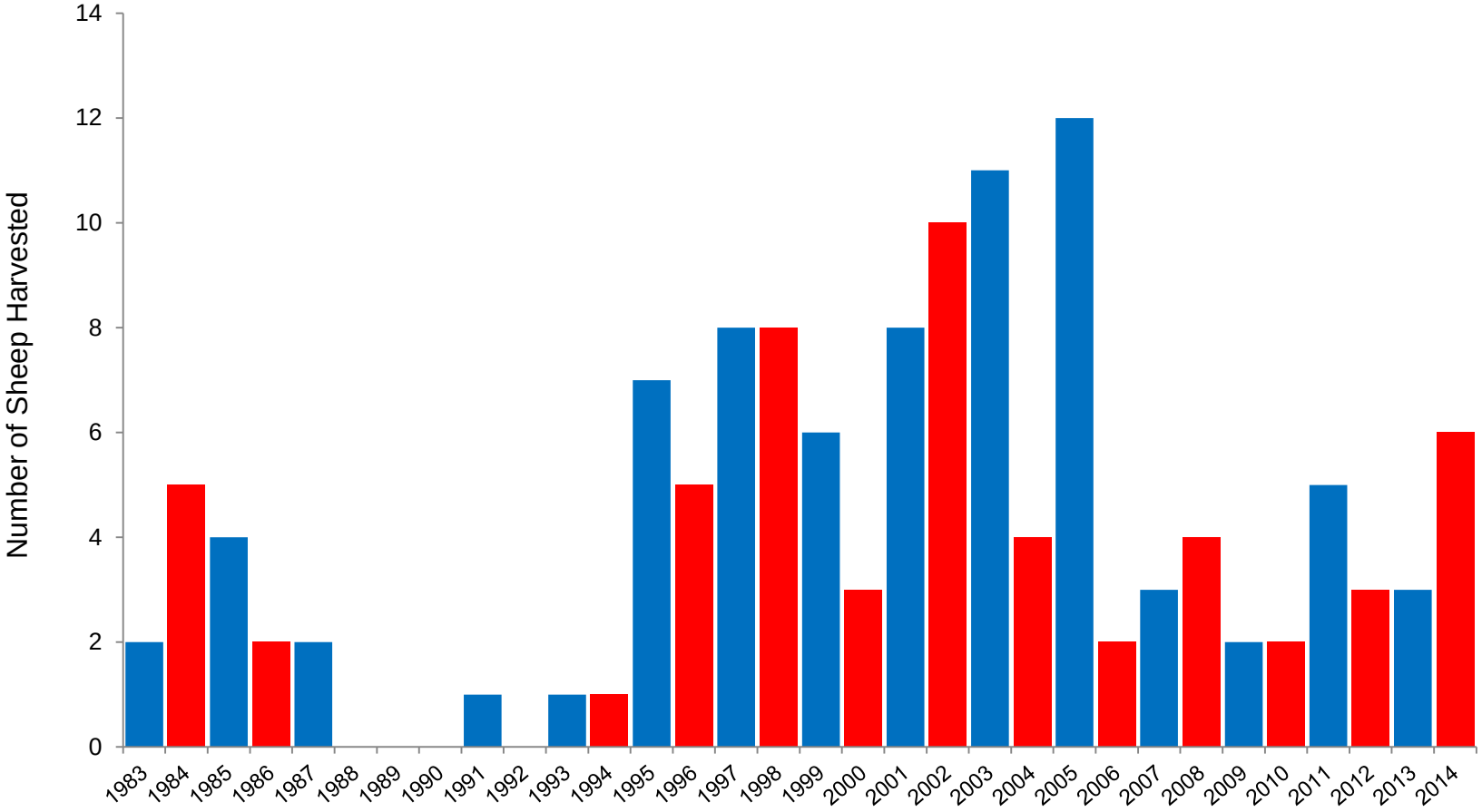
Appendix I. Continued

				Total Counts				Per 100 Ewes			Rams		
Survey	Year	Total	Survey	Ewes	Lambs	Yearlings	Rams	Lambs	Yearlings	Rams	Legal	Sublegal	%
Copper	1983	13	N/A	1	2	1	9	200	100	900	0	9	0
Mtn	1990	27	1.2	9	2	9	7	22	100	78	3	4	43
	1997	25	0.8	9	5	3	8	56	33	89	4	4	50
	1998	11	0.7	5	2	1	3	40	20	60	1	2	33
	1999	10	1.4	4	0	0	6	0	0	150	2	4	33
	2001	14	1.4	6	2	2	4	33	33	67	2	2	50
	2002	20	0.8	9	5	1	5	56	11	56	1	4	20
	2009	9	1.5	0	0	0	9				2	7	22
	2015	11	1.3	4	0	1	6	0	25	150	1	5	17
	Mean	16											
Charley	1997	39	1.4	25	11	3	0	44	12	0	0	0	0
River	1998	53	1.0	27	19	6	1	70	22	4	0	1	0
	1999	52	2.1	25	16	10	1	64	40	4	0	1	0
	2000	31	1.6	20	6	5	0	30	25	0	0	0	0
	2001	31	2.6	17	9	5	0	53	29	0	0	0	0
	2002	81	1.7	40	30	3	8	75	8	20	0	8	0
	2009	105	2.5	54	33	15	3	61	28	6	0	3	0
	2015	66	1.9	36	22	6	2	61	17	6	0	2	0
	Mean	53											
5580 Mtn	1997	24	0.5	10	6	5	3	60	50	30	0	3	0
	1998	35	0.4	17	11	3	4	65	18	24	0	4	0
	1999	20	0.5	10	5	5	0	50	50	0	0	0	0
	2000	27	0.5	12	4	7	4	33	58	33	1	3	25
	2001	32	0.5	13	6	5	8	46	38	62	2	6	25
	2002	29	0.5	17	4	4	4	24	24	24	3	1	75
	2009	23	0.7	9	3	7	4	33	78	44	0	4	0
	2015	12	0.7	7	3	0	2	42	0	29	0	2	0
	Mean	25											

Appendix I. Continued

				Total Counts				Per 100 Ewes			Rams		
Survey Unit	Year	Total	Survey Time	Ewes	Lambs	Yearlings	Rams	Lambs	Yearlings	Rams	Legal	Sublegal	% Legal
Mt Sorenson	1983	31	N/A	9	2	0	20	22	0	222	5	15	25
	1984	32	2.7	15	8	2	6	53	13	40	1	5	17
	1987	35	N/A	14	9	2	10	64	14	71	1	9	10
	1990	58	1.9	18	12	7	21	67	39	117	2	19	10
	1993	16	1.4	0	0	0	16	0	0	0	5	11	31
	1994	48	1.5	17	6	0	25	35	0	147	6	19	24
	1995	57	1.3	20	17	6	15	85	30	75	5	10	33
	1997	79	1.1	46	17	15	1	37	33	2	1	0	100
	1998	35	1.0	15	7	2	11	47	13	73	7	4	64
	1999	98	1.3	55	21	9	13	38	16	24	6	7	46
	2001	97	1.4	59	15	19	4	25	32	7	2	2	50
	2002	71	1.1	35	18	9	9	51	26	26	1	8	11
	2009	65	1.3	37	17	9	2	46	24	5	0	2	0
	2015	38	0.7	26	9	0	3	35	0	12	0	3	0
	Mean	54											
Twin Mtn	1983	35	N/A	12	10	3	11	83	25	92	1	10	9
	1990	48	1.5	15	13	4	16	87	27	107	0	16	0
	1997	54	1.2	23	11	4	16	48	17	70	4	12	25
	1998	49	0.8	23	10	6	10	43	26	43	3	7	30
	1999	62	0.5	22	10	6	24	45	27	109	6	18	25
	2000	62	1.0	22	8	4	28	36	18	127	6	22	21
	2001	27	0.7	3	3	0	21	100	0	700	7	14	33
	2002	17	0.6	3	2	0	12	67	0	400	5	7	42
	2009	40	0.8	12	5	4	19	42	33	158	4	15	21
	2015	9	1.0	0	0	1	8	-	-	-	1	7	13
	Mean	40											

Appendix B – Summary of Dall's sheep harvest data for Yukon-Charley Rivers National Preserve, 1983 – 2014.



Data from 1983 to 1994 comes from Burch 2010 and the remainder from the Alaska Department of Fish and Game. Harvest in 2007 may have been 4 sheep, not 3, but the harvest record is not specific enough to determine if it was in the Preserve or not.

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